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EFFICIENCY OF COMMERCIAL BANKS IN PAKISTAN: APPLICATION OF SFA AND VALUE ADDED APPROACH

The purpose of the study is to examine the efficiency of commercial banks in Pakistan over the period of 2005 to 2010. This study has used two-step process for this analysis. Firstly, we applied the Stochastic Frontier Approach (SFA) to examine the overall efficiency trend of commercial banks. We used the value added approach for the selection of input and output variables for the first time in Pakistan to examine the cost and profit efficiency of commercial banks. It is suggested that in developing countries with low savings of people, higher cost of deposits and high competition to attract larger number of deposits, it is inappropriate to place deposits as outputs instead of inputs by following an intermediation approach. The results suggested that the profit and cost efficiency of banks is slightly improved over the study period. Secondly, the association of various firm specific variables along with financial reforms and financial crises with the efficiency of the commercial banks is investigated. Tobit analysis results indicated that variables like size, profitability, equity and an increase in the minimum capital requirement are found to be positively related whereas the provision for advances (loans) is found to be negatively related with the efficiency of commercial banks in Pakistan. It can be concluded that the large size, higher solvency and increase in minimum capital requirement has helped the commercial banks to operate at an optimum level.

Keywords: Commercial Banks, Efficiency, Stochastic Frontier Approach, Value Added Approach, Minimum Capital Requirement.

1. INTRODUCTION

Commercial banks have the most significant role in the economic growth of a country because they mobilize the savings of investors, provide finance for potential businesses, create money 'out of thin air', facilitate national plus international trade and also act as institutional investors on capital markets. Moreover, commercial banks are also important due to their dynamic and stabilizing role for the economy. Therefore it is strongly expected from a

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commercial bank to work efficiently. A number of studies have investigated the efficiency of commercial banks in Pakistan (e.g. Akhter, 2002; Iimi, 2003; Ataullah, 2004; Patti, Hardly, 2005; Afza, Ammara, 2006, Qayyum & Sajawal, 2006; Ansari, 2006; Burki , Niazi, 2006; Qayyum, 2007; Ahmed, 2008; Nazir, Atia, 2010; Aftab et al, 2011; Junjua, Manzoor, 2011; Qayyum, Khalid, 2012). These studies have followed the intermediation approach for the selection of input and output variables to compute the efficiency scores instead of the value added approach. We failed to find any significant study which had applied the value added approach for the selection of input and output variables to compute cost efficiency and profit efficiency by following the parametric approaches.

The intermediation approach is an inappropriate approach to compute the efficiency scores in the case of developing countries. There are various reasons behind it; firstly, the intermediation approach considers the banks as the intermediaries which transform deposits into loans and investments with the use of labor and capital whereas, in contrast, the value added approach considers all categories of financial statements to have some output characteristics rather than distinguishing inputs from outputs in a mutually exclusive way, which is more appropriate. Secondly, the commercial banks are competing hard in Pakistan to attract higher deposits from savers since it is a developing country where people have low incomes. Thirdly, the State Bank of Pakistan (SBP) also implemented ceilings on Advances (loans) to Deposits Ratio (ADR) to financially strengthen the banking industry in Pakistan[1]. Therefore we cannot consider advances (loans) as a direct output of deposits by following the intermediation approach. Finally, the interest rates in Pakistan are also higher compared to developed economies of the world. Therefore commercial banks have to spend huge amounts to fulfill the requirements of its depositors, hence we have a strong case of following the value added approach instead of the intermediation approach in Pakistan. In addition, researchers have also recommended deposits as an output (Ferrier, Lovell, 1990; Berger, Humphery, 1992; Fukuyama, Webber, 2008) rather than an input. Although there are some studies which have followed the value added approach for the selection of input and output variables, none of these studies have investigated the cost and profit efficiency of commercial banks in Pakistan (Ilmi, 2003; Akmal, Saleem, 2008).

The value added approach for the selection of input and output variables is followed by various studies around the world. Ferrier and Lovell (1990)

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[1] The State Bank of Pakistan (2008) BSD Circular No. 27

applied the parametric Stochastic Frontier Approach (SFA) and non-parametric Data Envelopment Analysis (DEA) to investigate the cost efficiency of 575 US banks. The study followed the value added approach for the selection of input and output variables. The DEA results suggested that the banks were 84% technically efficient, 95% allocatively efficient and 79% cost efficient, whereas the SFA results indicated that the banks were 91% technically efficient and 74% cost efficient over the study period. Another study by Cadet (2010) analyzed the efficiency of banks in Haiti using the SFA technique over the period 2001 to 2007 by following the value added approach. This study found that foreign banks were more cost efficient compared to local banks. Bernini and Brighi (2012) investigated the efficiency of Italian commercial banks over the period of 2006 to 2009 using the SFA technique. The study also followed the value added approach for the selection of input and output variables. Mean cost efficiency was found to be 72% and the study also indicated that the efficiency level of commercial banks increased from 76% in 2006 to 80% in 2008 and then suddenly fell due to the financial crisis.

Gordo (2013) also examined the efficiency of commercial banks operating in the Philippines over the period of 1999 to 2009. The study followed the value added approach for the selection of input and output variables and found that the large size banks were on average more efficient than the small banks. Moreover, the study found the overall productivity of the banks was not improved.

1.1. Commercial Banks in Pakistan

Banks in Pakistan have gradually evolved since the central bank did not exist at the time of partition in 1947 and this gap was filled by the SBP in 1948. Initially, Habib Bank, Allied Bank and National Bank started their operations with the support of the SBP. In 1949 there were 147 bank branches operating in Pakistan which eventually increased to 3418 branches in 1971. At present there are twenty seven commercial banks with a branch network of more than ten thousand with total assets of more than 11 trillion rupees in 2010[2]. The commercial banks have shown significant progress in recent years since the total assets of the banks grew at an aggressive rate of 15.8% over the period of 2001 to 2009[5]. Moreover, the total deposits were 5 trillion rupees in 2010 as compared to just 2.2 trillion rupees in 2004. Furthermore, the total equity capital also improved from 138 billion rupees

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[2] Financial Stability Review by the State Bank of Pakistan (2010)

in 2004 to 577 billion rupees in 2010[3]. In addition, the commercial banks possessed a market capitalization of almost 20% at the Karachi Stock Exchange (KSE) which is the major stock market of the country. The banking sector of Pakistan has also shown significant technological progress in recent years and it is moving ahead towards an online banking system (almost 95% of branches) from the traditional banking.

In addition to conventional banks, Islamic banks are also participating in the economic development of the country. Therefore it is also important to compare the efficiency of the new born Islamic banks with the strong conventional banking sector of Pakistan. The first Islamic bank, Al Meezan Investment Bank, was granted a license in 2002. Now there are six fully fledged and twelve conventional banks, which have 905 branches dedicated to Islamic banking in seventy-six cities in Pakistan[4]. The total assets of Islamic banks were 641 billion rupees in 2011, compared to just 71.5 billion rupees in 2005[5]. The market share of the Islamic banks has also significantly increased from 1.95% to 7.8.

There are studies which have compared the efficiency of Islamic banks with the conventional banks. For instance, Majid et al (2003) studied the cost efficiency of 34 commercial banks of Malaysia over the period of 1993 to 2000 with the SFA technique. The results indicated that Islamic banks have almost the same level of efficiency as the conventional banks. Another study by Saaid et al (2003) compared the efficiency of conventional and Islamic banks operating in Sudan using the SFA technique. The study found lower efficiency scores in the Islamic banks.

There are some studies in Pakistan which have compared the efficiency of conventional banks with the Islamic banks such as Shahid et al (2010), who compared the efficiency of five conventional and five Islamic banks over the period of 2005 to 2009. The study followed the intermediation approach for the selection of input and output variables and applied DEA to compute the efficiency scores. The results show almost the same level of efficiency for both kinds of banks.

The major reason behind this significant growth of both conventional and Islamic banks in Pakistan is the strong control of the SBP. The SBP has taken various positive steps to financially strengthen the banking industry such as an increase in the minimum capital requirement for the commercial banks to enhance their financial soundness in anticipation of the Basel accords. The

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[3] Financial Stability Review by the State Bank of Pakistan (2011)
[4] Islamic Banking Review by the State Bank of Pakistan (2012)
[5] Islamic Banking Bulletin by the State Bank of Pakistan (2012)

minimum capital requirement for commercial banks was gradually enhanced from 1 billion rupees in 2003 to 7 billion rupees in 2010. There are empirical studies in literature which have investigated the impact of the increase in the minimum capital requirement on the efficiency of commercial banks. For instance Olaosebikan (2009) analyzed the impact of the increase in the minimum capital requirement in the Nigerian banks over the period of 1999 to 2005. The study found that the efficiency scores start to improve after the implementation of the capital requirements. Similar results were also reported by Isik and Hassan (2002), and Hauner and Peiris (2005). Therefore, it is important to examine whether in a developing country like Pakistan, the financial reforms have improved the efficiency of commercial banks or not.

Table 1

Increase in minimum capital requirements of commercial banks in Pakistan

Year	Capital Requirement (Rs)
2005	2 billion
2006	3 billion
2007	4 billion
2008	5 billion
2009	6 billion
2010	7 billion

Source: PhD Thesis submitted to COMSATS Institute of Information Technology, Lahore, Pakistan

Commercial banks also suffered from financial uncertainties in 2008. The financial crisis which started in the developed economies quickly spread to developing counties. It affected the emerging economies of the world depending upon the level of their integration into the global financial markets. Commercial banks were mostly affected due to the stock market crash in 2008-2009 since the Karachi Stock Exchange (KSE) 100 index dropped from 15,000 index points to 9,200 index points in a short period of just three months. Moreover, the KSE 100 Index closed at 5,865 index points in December 2008 – a huge loss of 58% as compared to December 2007[6]. The culprits behind this fall were ballooning trade, a fall in foreign reserves, lack of foreign investment, political instability, financial crisis and a worst macroeconomic scenario e.g. high inflation and interest rates.

Various studies have examined the effect of the financial crisis on banks' efficiency. For instance Azzam and Rettab (2014) examined the impact of

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[6] Ministry of Finance, Pakistan Economic Survey 2008-2009

the financial crisis on the efficiency of both the conventional and Islamic banks of the GCC. The study found that the growth of efficiency dropped after the financial crisis of 2008. Moreover, Islamic banks outperformed the conventional banks over the study period. Another study by Mghaieth and Mehdi (2014) examined the efficiency of 60 Islamic banks from 16 countries with the help of the SFA technique. The study found that the profit efficiency of the Islamic banks fell during the financial crisis in 2008 whereas the cost efficiency remained unchanged.

The objective of the present study is to evaluate the efficiency of the commercial banks with the selection of the value added approach since it is a more appropriate approach compared to the intermediation approach. Moreover, the study will further compare the efficiency of conventional banks with the Islamic banks operating in Pakistan, and finally, the study will further examine the relationship of various firm specific variables along with the impact of the financial reforms and the financial crisis with the efficiency of commercial banks. The remainder of the paper is organized as follows: the next section describes the methodology followed in this study. Section 3 explains the descriptive analysis of the data, whereas the results of efficiency of the commercial banks in Pakistan are given in section 4, and the study finishes with some concluding remarks in section 5.

2. METHODOLOGY

There are empirical studies which have investigated the efficiency of commercial banks with the help of parametric approaches. This study has followed the Stochastic Frontier Approach (SFA) to measure the efficiency of commercial banks since the other parametric approaches do not fulfill our analysis requirements and the Distribution Free Approach (DFA) has problems with the inefficiency component of the error term for a period of six years or more, whereas the Thick Frontier Approach (TFA) does not provide firm wise efficiency scores (Asghar, Afza, 2013).

This study has computed cost efficiency and profit efficiency with the help of the SFA technique since cost minimization and profit maximization are one of the important efficiencies which are extensively calculated by empirical studies. The cost function of SFA describes the minimization of input at a given level of output. Any deviation from the minimum possible input level is considered as an inefficiency. The SFA's cost frontier is based on an equation which relates a firm's cost to various variables that incur

those costs, such as output levels and input prices along with the inefficiency and random error. The following equation can describe the relationship as;

$$TC = f(y, w, z) + u + v,$$ (1)

here TC is the total cost of the firm; y is a vector of output variables, w is a vector of input prices variables, z is the vector for various firm parameters that can influence the efficiency, u is the inefficiency term that captures the difference between the efficient level of cost for a given level of output and input prices and the actual level of cost, and v is the random error term. The same equation can be written in a natural logarithm form as:

$$\ln TC = f(y, w, z) + \ln u + \ln v.$$ (2)

After computing the cost function, we can estimate the cost efficiency (*COSTEFF*) for each firm as the ratio among the minimum cost (C_{min}) necessary to produce that firm's output and the actual cost (C):

$$COSTEFF = \frac{C_{min}}{C}.$$ (3)

Using the following translog function[7] $\ln(TC)$ can be written as:

$$\ln TC_{kt} = \alpha_0 + \sum_{i=1}^{3} \alpha_i \ln y_{ikt} + \sum_{i=1}^{3} \beta_i \ln w_{ikt} + 0.5 \sum_{i=1}^{3} \sum_{j=1}^{3} \alpha_{ij} \ln y_{ikt} \ln y_{jkt} +$$

$$+ 0.5 \sum_{i=1}^{3} \sum_{j=1}^{3} \beta_{ij} \ln w_{ikt} \ln w_{jkt} + \sum_{i=1}^{3} \sum_{j=1}^{3} \gamma_{ij} \ln y_{ikt} \ln w_{jkt} + v_i + u_i,$$ (4)

where TC is the total cost, y_i is the ith output, w_i is the *i*th input price, v_i is the random error and u_i is the inefficiency as described earlier. The subscripts *i*, *j*, *k* are for outputs and input prices, and *t* for time. It is required by the duality theorem that the translog function must be linearly homogeneous in input prices and continuity requires that the second order parameters must be symmetric (Lang & Peter, 1999). In other words, hence linear homogeneity, this study has chosen one input price and divides it with all the other input prices and also with the dependent variable before taking their natural logs. This research study also included z into the model to account for the variable that can affect the structure of the frontier (Kiyota, 2011). Size (*z*) is measured by total assets of the firm following Sun and Chen (2011), and Baten and Anton (2010). Moreover, to accommodate technological change

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[7] The translog function is selected since it is widely accepted to accommodate multiple input and output variables (Cummins and Weiss, 2000; Eling and Luhnen, 2009).

over time, t is also included which represents time factor (Eling, Luhnen, 2009). The same model was also followed by Bos and Kool (2001). Now, the final step to compute the cost efficiency is:

$$
\begin{aligned}
\ln TC_{kt} = {} & \alpha_0 + \sum_{i=1}^{3} \alpha_i \ln y_{ikt} + \sum_{i=1}^{3} \beta_i \ln w_{ikt} + 0.5 \sum_{i=1}^{3}\sum_{j=1}^{3} \alpha_{ij} \ln y_{ikt} \ln y_{jkt} + \\
& + 0.5 \sum_{i=1}^{3}\sum_{j=1}^{3} \beta_{ij} \ln w_{ikt} \ln w_{jkt} + \sum_{i=1}^{3}\sum_{j=1}^{3} \gamma_{ij} \ln y_{ikt} w_{jkt} + \sum_{i=1}^{3} \delta_i \ln z_{kt} + \\
& + 0.5 \sum_{i=1}^{3} \delta_i (\ln z_{kt})^2 + \sum_{i=1}^{3} \partial_i \ln z_{kt} \ln w_{ikt} + \sum_{i=1}^{3} \theta_i \ln z_{kt} \ln y_{ikt} + \\
& + \Omega t + 0.5\Omega t^2 + \sum_{i=1}^{3} \phi_i \ln w_{ikt} t + \sum_{i=1}^{3} \mho_i \ln y_{ikt} \, t + \sum_{i=1}^{3} \acute{\emptyset}_i \ln z_{kt} t + v_{kt} + u_{kt}
\end{aligned} \tag{5}
$$

According to Berger and Mester (1999), "profit maximization is superior to cost minimization for most purposes because it is the more accepted economic goal of firms and firms' owners, who take revenues as well as costs into account when making decisions". All the explanatory variables remain the same as in the cost function in (5), the dependent variable replaces total cost with total profit and the inefficiency term (u_i) is subtracted from the random error term (v_i) instead of the addition, due to the production nature of the function. The translog function does not include the negative profits, since the natural log of the all the variables is required, therefore we have added the lowest profit (biggest loss) into the profits of all firms and then added 1, following various studies (Delis et al, 2008). In other words, the dependent variable for the profit function can be described as $\ln(\pi+k+1)$ where π is the profit of the firm, k is the absolute value of the minimum profit value. Now the profit function is:

$$
\begin{aligned}
\ln(\pi + k + 1)_{kt} = {} & \alpha_0 + \sum_{i=1}^{3} \alpha_i \ln y_{ikt} + \sum_{i=1}^{3} \beta_i \ln w_{ikt} + 0.5 \sum_{i=1}^{3}\sum_{j=1}^{3} \alpha_{ij} \ln y_{ikt} \ln y_{jkt} + \\
& 0.5 \sum_{i=1}^{3}\sum_{j=1}^{3} \beta_{ij} \ln w_{ikt} \ln w_{jkt} + \sum_{i=1}^{3}\sum_{j=1}^{3} \gamma_{ij} \ln y_{ikt} \ln w_{jkt} + \\
& \sum_{i=1}^{3} \delta_i \ln z_{kt} + 0.5 \sum_{i=1}^{3} \delta_i(\ln z_{kt})^2 + \sum_{i=1}^{3} \partial_i \ln z_{kt} \ln w_{ikt} + \\
& \sum_{i=1}^{3} \theta_i \ln z_{kt} \ln y_{ikt} + \Omega t + 0.5\Omega t^2 + \sum_{i=1}^{3} \phi_i \ln w_{ikt} t + \\
& \sum_{i=1}^{3} \mho_i \ln y_{ikt} \, t + \sum_{i=1}^{3} \acute{\emptyset}_i \ln z_{kt} t + v_{kt} - u_{kt}
\end{aligned} \tag{6}
$$

2.1. Input Prices and Output Variables

The SFA computes the efficiency scores based on output and input prices. Therefore in this study we selected: advances (loans), deposits and investments as outputs, whereas labor (total salaries including all kinds of incentives to labor / number of employees), business services (all the expenses except the labor expenses / fixed assets) and physical assets (fixed assets / total assets) are selected as inputs. These output and input price variables were also selected by Angelidis and Katerina (2006), Maudos et al (2002) and Pastor et al (1997). The total cost is measured as the total financial and operating cost incurred by the commercial banks, whereas the total profit is measured as earnings before interest and taxes. The summary of these outputs and input prices is given in Table 2.

Table 2

Outputs and input prices

Type	Variable	Measurement
Outputs (*y*)	Advances	Total Loans
	Deposits	Total Deposits
	Investments	Total Investments
Input Prices (*w*)	Labor	Labor / Number of Employees
	Business Services	Business Services / Fixed Assets
	Physical Capital	Fixed Assets / Total Assets

2.2. Determinants of Efficiency

This study has further examined the association of firm specific characteristics, financial reforms and financial crisis with the profit efficiency and cost efficiency scores of the commercial banks. The firm's characteristics include: size, risk, profitability, solvency, liquidity, non-interest income and the provision for advances, whereas the financial reforms include: increase in the minimum capital requirement imposed by the SBP and finally the financial crisis of 2008.

The relationship between the size of the bank and its efficiency is important for all of the stakeholders. We are assuming that the size has a positive relationship with the efficiency of the banks since it gives them highly professional management (Evanoff, Israilevich, 1991), a larger market in which to operate (Dong, 2009), and also helps them to diversify

their risks (Cole, Gunther, 1996). The size of the banks is measured as the natural log of total assets.

H1: There is a positive association between size and efficiency.

Every business faces operational risk and its intensity is higher in the case of commercial banks due to their nature of business. The study is expecting a negative association of efficiency with the operational risk since it increases the cost of doing business and eventually decreases the profitability of the banks. This study has measured operational risk as advances to deposits, following Chortareas et al (2010).

H2: There is a negative association between risk and efficiency.

Shareholders always want to earn higher profit to maximize their wealth. Therefore it is also important to examine its relationship with the efficiency scores. This study is expecting a positive relationship of profitability with the efficiency of commercial banks. The profitability of banks is measured as Return on Equity (ROE).

H3: There is a positive association between profitability and efficiency.

Equity is also frequently used as one of the main determinants of efficiency in the empirical literature. The study is expecting equity to be positively related with commercial banks' efficiency since it strengthens them financially. Equity is measured as total equity to total assets.

H4: There is a positive association between equity and efficiency.

Liquidity measures the ability of a firm to meet its short term obligations. Therefore, it is essential to investigate the relationship of liquidity with various efficiencies. It is expected to be positively related with the efficiency of commercial banks since it reduces the risk. Liquidity is measured as the sum of cash, T–bills, and deposits held with other financial institutions divided by total assets.

H5: There is a positive association between liquidity and efficiency.

It is also important to examine the relationship of non-interest income with the efficiency scores, since a positive association suggests that commercial banks have the ability to offer new non-interest income products to improve their efficiency, whereas a negative association would suggest that the commercial banks have to focus on the traditional commercial operations. This study has measured the non-interest income as total non-interest income over total assets by following San et al (2011).

H6: There is a positive association between non-interest income and efficiency.

The commercial banks are facing various challenges these days which compel them to maintain a provision for advances (loans) to overcome the

problem of bad loans. An adequate cash reserve is viewed as a cushion mechanism to ensure that the commercial banks may not unexpectedly lose their outstanding loans. The financial crisis has also raised its importance. This study is expecting a negative relationship between provision for advances (loans) and the efficiency scores since provision increases the cost and ultimately decreases the profit. The provision for advances is measured as the total provision for advances to total advances.

H7: There is a negative association between provision for loans and efficiency.

There are Islamic banks operating in the country which provide Sharia-compliant products to its customers. Therefore, this study has also tried to investigate the relationship of Islamic banks with the efficiency scores. This study has used a dummy denoted by *Dtype* for this purpose having the value of 1 for Islamic banks and 0 otherwise. It is expected that the Islamic banks will be positively related with the efficiency scores as it will suggest that they are more efficient than the conventional banks since most of the population is Muslim.

H8: There is a positive association between Islamic banks and efficiency.

The year 2008 proved to be a nightmare for the financial markets around the world including Pakistan. The financial market crisis is more important in emerging markets since frequent internal and external shocks (such as inflation and the depreciation of local currency) along with other factors also caused the market to be more volatile (Zikovic and Bora, 2009). The Karachi Stock Exchange (KSE) 100 index peaked at 15,737.32 points on 20 April 2008 and then the stock market collapsed by 55 percent (5600 points) in just a four-month period. On 20 August 2008, a floor was at the level of 9144 points. It remained in place for 108 days and was finally lifted on 14 December 2008. This stock market crash adversely affected all the financial institutions, especially the commercial banks since they are the major institutional investors. Therefore we have included a dummy variable to capture the effect on the efficiency of commercial banks. The dummy variable has a value of 1 for the year 2008 and 0 otherwise.

H9: There is a negative association between financial crisis and efficiency.

During the last two decades many countries have made various financial reforms to strengthen their banking sectors. Although the regulators want to achieve various objectives with these regulatory changes, the prime goal of these reforms is to increase the level of healthy competition amongst the commercial banks. Moreover, by following this strategy, they not only reduce the overall cost of doing business but also improve the level of

productivity which eventually results in an increase of efficiency. One of the major financial reforms made by the regulators is the increase in the minimum capital requirement of the commercial banks to financially strengthen them (see Table 1).

The details of the increase in the minimum capital requirements of commercial banks in Pakistan is given in Table 2. To investigate its relationship with the efficiency of banks, we used a dummy variable which equals 1 for those banks which have increased their share capital to meet the minimum capital requirement in a particular year and 0 otherwise.

H10: There is a positive association between the increase in minimum capital requirement and efficiency.

Concluding the above discussion, we ended up with the following model

$$\theta_{i,t} = \beta_1 + \beta_2 SZ_{i,t} + \beta_3 ADVDEP_{i,t} + \beta_4 PROF_{i,t} + \beta_5 LQDTY_{i,t} +$$
$$\beta_6 EQTY_{i,t} + \beta_7 NII_{i,t} + \beta_8 PROVADV_{i,t} +$$
$$\lambda_9 Dtype_{i,t} + \lambda_{10} Dreg_{i,t} + \lambda_{11} Dun_{i,t} + \varepsilon_{i,t}$$

where: θ – Profit efficiency or Cost efficiency
       SZ – Natural log of Total Assets
       $ADVDEP$ – Total Advances (loans) / Total Deposits (%)
       $PROF$ – Profit before tax / Equity (%)
       $LQDTY$ – Cash + Cash in T–bills + Cash with other Financial
                 Institutions / Total Assets (%)
       $EQTY$ – Total Equity / Total Assets (%)
       NII – Non-Interest Income / Total Assets (%)
       $PROVADV$ – Provision for Advances / Total Advances (%)
       $Dtype$ – Dummy variable; 1 if the mean of business is Islamic
                 banks and 0 otherwise
       $Dreg$ – Dummy variable; 1 if paid-up capital is increased by the
                 bank to meet the minimum capital requirement, and 0
                 otherwise
       Dun – Dummy variable; 1 for year 2008 and 0 otherwise

3. EMPIRICAL DATA AND ANALYSIS

This study has included all of the 27 public and private commercial banks in Pakistan operating in 2005-2010. Data is collected from the annual reports of these banks. The descriptive statistics of the variables used for the computation of efficiency scores are provided in Table 3. The investments

Table 3. Descriptive Statistics of Commercial Banks (Outputs and Input Prices)

Year	Obs		Outputs			Input Prices			Total Cost	Total Profit
			Investments	Advances	Deposits	Price of Labor	Price of Business Services	Price of Physical Assets		
2005	20	**Mean**	33249.35	81101.10	118674.83	36.8	66.3	2.234	6035.274	3900.185
		SD	39954.31	91482.97	137672.50	11.8	42.5	1.708	6362.732	5464.498
2006	22	**Mean**	33446.48	95685.03	131753.09	37.3	61.8	2.605	8896.638	5263.257
		SD	37277.99	100843.78	143976.59	11.6	37.0	2.228	8553.138	7636.622
2007	26	**Mean**	46304.67	93507.24	137899.35	46.0	56.3	3.507	10452.135	4324.131
		SD	55606.32	107797.70	162085.77	12.9	46.0	2.538	10549.359	7221.229
2008	27	**Mean**	37667.51	107173.13	145630.14	54.8	61.0	4.106	13382.098	6440.399
		SD	45468.63	128947.56	178193.95	16.2	46.0	2.791	13530.292	22534.420
2009	27	**Mean**	60425.47	109611.42	166477.95	60.8	55.8	3.700	16789.169	2804.099
		SD	64284.80	133368.68	198527.82	17.5	28.4	2.117	16952.094	8511.776
2010	27	**Mean**	75926.49	117054.34	193671.14	65.7	60.2	3.172	19635.918	3964.649
		SD	83829.30	132020.61	222226.49	20.8	30.4	1.384	18299.877	9321.807
Average	149	**Mean**	49015.15	101825.04	151097.23	51.3	60.0	3.286	12973.027	4448.790
		SD	59147.37	117142.71	177757.69	19.0	38.4	2.245	14026.047	11811.862
		Min	1606.5	1184.84	1022.7	0.20	0.13	0.44	67.13	1
		Max	301323	477506	832151.9	2.21	2.21	11.54	71453	514.27
Total Commercial Banks								27		

Source: authors' own

Investments   Total investments in million rupees
Advances   Total advances in million rupees
Deposits   Total deposits in million rupees
Price of Labor   Total salaries including all other incentives / Number of Employees (%)
Price of Business Services   Total operating expenses excluding labor / Operating Fixed Assets (%)
Physical Assets   Total operating Fixed Assets / Total Assets (%)
Total Cost   Total interest and Operating Expenses in million rupees
Total Profit   Total profit before tax in million rupees

significantly increased from 33,249 million rupees to 75,925 million rupees. This indicates that the commercial banks have shown great interest in investing their money in the financial markets. The advances (loans) and deposits also significantly increased from 81,101 million and 118,575 million rupees to 117,054 million and 193,671 million rupees, respectively, i.e. the advances and deposits grew by 44% and 63%, respectively over the study period. Three input variables: labor, business services and physical assets also increased significantly in 2005-2010. The price of labor increased from 0.37 million to 0.66 million rupees because of the high inflation rate and hiring of employees at higher salary packages. The price of business services remains almost the same due to the fact that the fixed assets also increased along with the business services. The price of physical assets also increased from 2.23% to 3.17% since the commercial banks have increased their branch network across the country to raise their market share.

As a result of the increase in the cost of inputs, the total cost of the commercial banks also increased significantly in the period under study, whereas the profitability of the commercial banks decreased from 6440 million in 2008 to 2804 million rupees in 2009 because of various economic uncertainties. The standard deviation of all the outputs and input prices along with other variables is high which is due to the fact that the banking sector in Pakistan is highly fragmented.

The descriptive statistics of variables which are used for the Tobit analysis are given in Table 4. The results suggest that the size of the commercial banks has significantly increased. Advances to deposits decreased over the study period, possibly as a result of rising interest rates in the later part of the study period which eventually proportionally decreased the borrowing from banks.

The profits of the commercial banks dramatically increased between 2006 and 2008, and then sharply fell in 2009. This indicates that the financial crisis of 2009 has significantly decreased the profitability of the commercial banks in Pakistan. Liquidity was the same in 2010 as in 2005. Cost of equity significantly increased from 2005 to 2008 but slightly decreased in 2009 and 2010.

Non-Interest Income (*NII*) and Provision for Advances (*PROVADV*) remained same over the period under study which indicates that the commercial banks have a stable policy in this regard. *Dtype* shows that Islamic commercial banks grew from 5% to 18.5%, i.e. the new Islamic banks are now flourishing in Pakistan. *Dreg* reveals that the percentage of

Table 4. Descriptive Statistics of Commercial Banks (Tobit Model)

Variables	2005		2006		2007		2008		2009		2010		Average			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Min	Max
SZ (log)	11.205	1.321	11.314	1.437	11.292	1.453	11.305	1.473	11.533	1.414	11.701	1.355	11.404	1.399	8.65	13.85
ADVDEP	71.00	17.50	71.90	16.60	66.00	16.00	76.70	17.90	65.00	15.50	62.80	14.40	68.70	16.80	0.28	1.335
PROF	27.659	28.184	22.818	26.000	27.477	58.798	-6.951	70.176	-0.648	35.513	2.298	61.479	11.073	52.481	-10.73	6.19
LQDTY	11.182	4.635	12.553	4.104	11.076	5.151	9.867	4.755	9.276	4.004	9.629	3.812	10.501	4.495	15.07	70.86
EQTY	8.447	5.599	11.429	10.767	15.342	11.919	15.772	11.227	12.553	9.426	10.918	7.586	12.610	9.927	0.29	54.14
NII	1.217	0.435	1.308	0.526	1.620	0.674	1.350	0.555	1.130	0.454	1.104	0.573	1.289	0.566	0.12	3.03
PROVADV	2.570	5.959	1.403	2.674	2.337	4.340	2.770	3.550	3.049	2.421	2.140	2.728	2.402	3.684	-4.94	26.32
Dtype	0.050	0.224	0.045	0.213	0.154	0.368	0.185	0.396	0.185	0.396	0.185	0.396	0.141	0.349	0	1
Dreg	0.400	0.503	0.364	0.492	0.308	0.471	0.259	0.447	0.296	0.465	0.222	0.424	0.302	0.461	0	1
Dun	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.181	0.386	0	1
Obs.	20		22		26		27		27		27		149			

Source: authors' own

SZ (millions)   Total Assets
SZ.   Natural log of Total Assets
ADVDEP   Total Advances / Total Deposits(%)
PROF   Profit before tax / Equity (%)
LQDTY   Cash + Cash in T–bills + Cash with other Financial Institutions / Total Assets (%)
EQTY   Total Equity / Total Assets (%)
NII   Non–Interest Income / Total Assets (%)
PROVADV   Provision for Advances / Total Advances (%)
Dtype   Dummy variable; 1 if the mean of business is Islamic banks and 0 otherwise
Dreg   Dummy variable; 1 if paid up capital is increased by the bank to meet the minimum capital requirement and 0 otherwise
Dun   Dummy variable; 1 for year 2008 and 0 otherwise

the commercial banks which raised their minimum capital requirement to meet the regulatory requirements imposed by the SBP decreased over the study period. This result is due to the fact that most of the banks had already raised their minimum capital in the initial years to survive in the market through IPOs, mergers and acquisitions, etc. Another important finding is that the correlation amongst the independent variables is restrained and there is no problem of multicollinearity in this model.

4. RESULTS AND DISCUSSION

The efficiency results of the commercial banks in Pakistan are provided in Table 5 demonstrating that banks are on average 69.4% profit efficient and 84.9% cost efficient. A similar level of technical efficiency was also found by Tahir and Haron (2008) for Malaysian commercial banks. This indicates that the commercial banks in Pakistan are generating 31.6% lower profits at the same input prices to produce maximum outputs, while the cost efficiency results suggest that the commercial banks can reduce their costs by 16.1% to produce the same level of outputs.

The profit efficiency results show that Soneri Bank, SME Bank and the National Bank of Pakistan are the most efficient banks. The National Bank is the largest bank in Pakistan which gives it an operational edge over its rivals, whereas Soneri Bank and SME Bank are small banks. This indicates that the small banks are also flourishing in the country which can be related to their optimum utilization of resources to produce higher output. The least profit efficiency is found in the Al Baraka bank which is an Islamic bank. This result is due to the fact that the bank has earned negative profits in the four consecutive years from 2007 to 2010.

The overall profit efficiency of the Islamic banks (67.4%) is also found lower than in the conventional banks (70%). This result suggests that the Islamic banks are not as profitable as the conventional banks which may relate to their small sizes and recent entrance into the banking industry.

The cost efficiency of the Al Habib Bank, The Standard Chartered Bank, Habib Bank and Muslim Commercial Bank is found to be highest. The Habib Bank and Muslim Commercial Bank are among the five largest commercial banks in Pakistan. This suggests that the largest five banks are not only amongst the highest earners but are also enjoying the economies of scale to reduce their costs. Moreover, the mean profit efficiency and cost efficiency of the five largest banks is found to be higher than the mean efficiencies of all the banks. The Standard Chartered Bank and the Al Habib

Table 5

Efficiency of Commercial Banks in Pakistan

Average (2005–2010)		
Commercial Banks	**Profit Efficiency**	**Cost Efficiency**
Allied Bank	0.712	0.878
Al Baraka Bank	0.418	0.822
Alfalah Bank	0.55	0.802
Alhabib Bank	0.498	0.932
Askari Bank	0.619	0.87
Bank Islami	0.846	0.902
Bank of Punjab	0.584	0.673
Burj or Dawood Bank	0.797	0.886
Dubai Islamic Bank	0.617	0.905
Faysal Bank	0.832	0.845
First Women Bank	0.799	0.874
Habib Metro Bank	0.897	0.9
Habib Bank	0.733	0.904
JS Bank	0.515	0.724
KASB Bank	0.551	0.824
Khyber Bank	0.592	0.869
Muslim Commercial Bank	0.846	0.904
Meezan Bank	0.689	0.893
National Bank of Pakistan	0.922	0.887
National Investment Bank	0.721	0.818
Samba Bank	0.474	0.727
Silk Bank	0.56	0.815
SME Bank	0.929	0.869
Soneri Bank	0.931	0.867
Standard Chartered Bank	0.775	0.917
Summit Bank	0.668	0.78
United Bank	0.669	0.84
Mean (All)	0.694	0.849
Mean (Islamic)	0.674	0.881
Mean (Conventional Bank)	0.700	0.842
Mean (Top 5 Banks)	0.7764	0.8826
Maximum	0.931	0.932
Minimum	0.418	0.673

Source: authors' own

Bank are medium sized promising banks in Pakistan which are growing recently in the country. The Bank of Punjab (BOP) is found to be the least cost efficient bank, therefore it needs to reduce its costs to improve cost efficiency. The major reason behind their inefficiency is a political influence

on the Bank of Punjab exerted by the government of Punjab since the BOP has financed various government development projects, which eventually raised the provision for non-performing loans in 2008 and 2009 (18.9 and 9.2 billion rupees, respectively). Moreover the SBP also allowed the Bank of Punjab to delay the declaration of their annual report for a period of three years after 2008, since the former President of the bank brought the bank to a stage of collapse due to various mismanagements and also due to financing various unproductive government schemes. As a result, the BOP has continuously earned a negative profit in the last three years under study (2008 to 2010).

Figure 1 shows the general trend of efficiency results in 2005-2010. The general efficiency trend of all commercial banks indicates that both profit and cost efficiencies remained the same (see Figure 1-a). However, the analysis of trends in conventional banks and Islamic banks (see Figure 1-b and 1-c) implies that the profit efficiency results for conventional and Islamic banks reveal a totally different picture. It was found that the conventional banks have a decreasing efficiency trend, whereas in contrast, the Islamic banks have an increasing efficiency trend. This suggests that the Islamic banks are becoming more profitable as compared to the conventional banks in recent years. The fall in profit efficiency of conventional banks can be attributed to higher competition as a result of financial reforms, after many of the commercial banks merged to raise their minimum capital requirement in accordance with the regulations of the SBP. Moreover, the financial crisis also caused the fall of profit efficiency in conventional banks since it affected the investments of commercial banks, particularly in the major stock market of the country (Karachi Stock Exchange).

The relationship of efficiency scores with the various variables are provided in Table 6. Size is found positively and significantly related to the cost and profit efficiency of commercial banks in Pakistan. Badrul and Mohd (2013) also found the positive relationship of size with the efficiency of banks. This indicates that a large bank's access in the market and the hiring of experienced management helped them to operate at an optimum level. Profitability is also found positively and significantly related with the profit efficiency of the commercial banks. Hassan (2004) also found a positive association of profitability with the efficiency of banks. This indicates that commercial banks with higher profit will have higher profit efficiency.
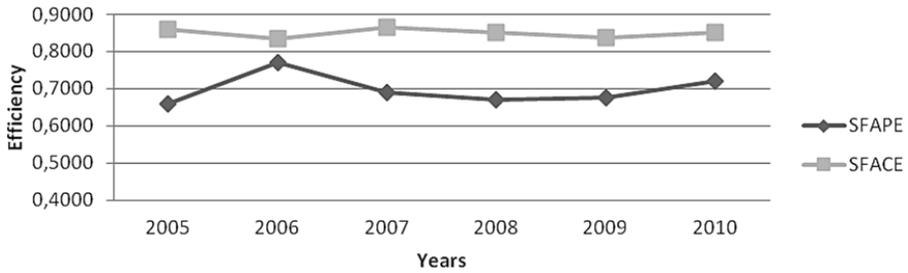
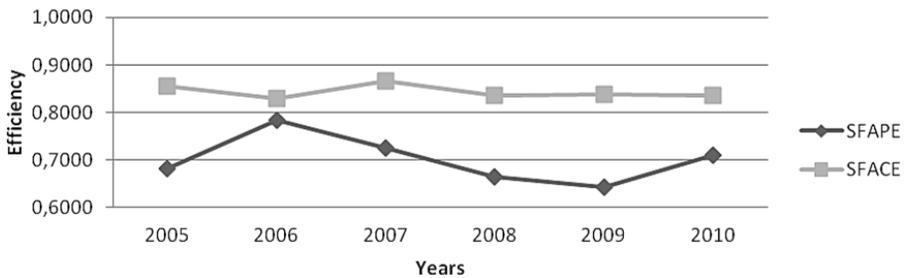Figure 1-a. Efficiency of All Commercial Banks

Figure 1-b. Efficiency of Conventional Commercial Banks
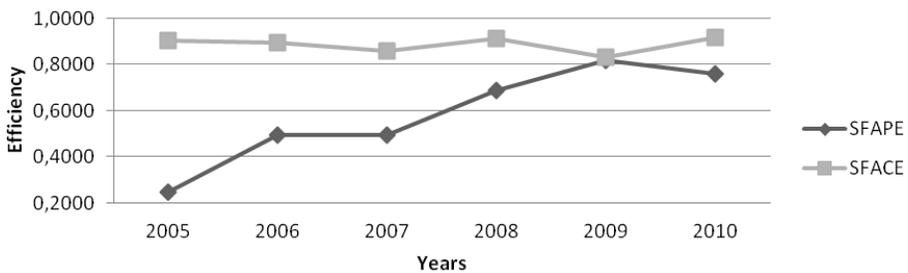

Figure 1-c. Efficiency of Islamic Banks

SFAPE: Profit Efficiency computed with the Stochastic Frontier Approach
SFACE: Cost Efficiency computed with the Stochastic Frontier Approach

Source: Efficiency Analysis of Banks over the period of 2005-2010 (Analysis of this study)

Table 6

Determinants of Efficiency in Commercial Banks of Pakistan

Variables	Expected Sign	Profit Efficiency			Cost Efficiency		
		β	SE	Sig	β	SE	Sig
SZ	+	0.0413**	0.019	0.031	0.0189**	0.009	0.034
ADVDEP	−	0.2177*	0.125	0.085	0.0936	0.059	0.112
PROF	+	0.0003***	0.000	0.003	0.0001	0.000	0.658
LQDTY	+ / −	−0.0015	0.005	0.759	0.0033	0.002	0.157
EQTY	+	0.0055**	0.003	0.033	0.0009	0.001	0.469
NII	+ / −	−0.0147	0.037	0.692	-0.0268	0.017	0.123
PROVADV	−	−0.016***	0.005	0.003	-0.0046*	0.002	0.057
Dtype	+ / −	−0.0105	0.062	0.865	0.0325	0.029	0.262
Dreg	+	0.0711*	0.041	0.085	0.0105	0.019	0.585
Dun	−	−0.0725	0.049	0.138	-0.0017	0.023	0.939
Cons		0.0751	0.240	0.755	0.5616***	0.113	0
LR Chi		36.65			17.94		
Prob>Chi		0.0001			0.056		
Likelihood		7.25635			129.02323		
Pseudo R^2		1.6556			−0.0747		
Obs		149			149		

Source: authors' own

Equity is found positively and significantly related with the profit efficiency which indicates that a higher equity level raises the solvency of the commercial banks. Moreover, it also provides extra money for investments in commercial banks which actually decreases the fixed cost of the commercial banks to earn higher profit. This result suggests that the regulators have to keep increasing the minimum capital requirements of banks since it has a positive association with the efficiency scores. Provision for advances is found negatively and significantly related with both efficiencies of the commercial banks. This indicates that higher provision for advances actually increases the cost of doing business. Therefore the management of the commercial banks needs to control these losses.

Financial reforms are found significantly and positively associated with profit efficiency. The regulatory policy regarding the increase of minimum capital requirement has made a positive impact on the profits of commercial banks. Ediz et al (1998), Aggarwal and Jacques (1998), Rime (2001), Aggarwal and Jacques (2001), and Van Roy (2008) also found partial support that the improvement in the level of efficiency is due to the increase in the minimum capital requirements. The study has followed the methodology of many papers which used the Tobit model. To the best of our knowledge, there are not many empirical studies checking for robustness of

the Tobit regression model in the case of efficiency scores. Naceura et al (2011) applied the OLS for robustness check of the Tobit model, therefore we also applied OLS and found that the results were consistent.

CONCLUSION

The study of efficiency in the commercial banks is of importance to bank regulators, managers, investors and customers as it provides an overview of the existing performance of the banking industry. Regulators can examine the market structure and the efficiency trends over the years and the results can also help them to identify the problems in industry. Efficiency scores are also helpful for managers because they are derived from several associated input and output variables. Therefore the management can easily identify those inputs and outputs which are causing the inefficiency in a particular bank. Moreover, the efficiency scores are also beneficial for the investors and customers as they can rank the commercial banks based on their efficiency scores to make a rational choice.

This study used a two-step process to analyze the efficiency of commercial banks in Pakistan during 2005-2010. In the first step, we computed the efficiency scores of each commercial bank using the SFA. In the second step, we applied a Tobit analysis to investigate the association of various variables with the efficiency scores of commercial banks. The results reveal that the commercial banks have a moderate level of efficiency. The largest five commercial banks are found to be more cost efficient, as well as profit efficient, than the rest of the commercial banks. This implies that the large banks have the advantage of a large branch network, skilled labor and experience which enable them to compete with the medium and small sized rivals. Some of the small and medium size banks are also found amongst the efficient banks, which is a positive sign indicating that the small banks with a promising strategy can also compete with the large banks. The results also show that the political influence on a particular bank (e.g. the BOP) can adversely affect the efficiency of the bank. Therefore the management of the BOP needs to develop a framework to screen the offered governmental projects on a merit basis to work efficiently, as unsound projects increase the cost of doing business.

Islamic banks like Al Baraka are found amongst the least efficient banks. Therefore the Islamic banks need to come up with more innovative Sharia-compliant products to attract a higher number of customers, because many of the Muslims in Pakistan want to invest in such profitable products. Moreover, the Islamic banks need to increase their branch network within

the country at a local (*tehsil*) level since the branch network of Islamic banks in comparison to conventional banks is small.

The efficiency trend analysis indicates that the efficiency remains similar over the examined period, especially the cost efficiency of the banks. The profit efficiency results, however, show that the profit efficiency of the conventional banks has fallen, whereas it has increased for the Islamic banks. The increase in the profit efficiency of Islamic banks indicates that over the years the Islamic banks are now more mature, therefore most of these banks are now earning better profits. The fall in the profit efficiency of the conventional banks can be attributed to intense competition, conservative banking policy (due to increasing interest rates) and financial crisis discussed in the later part of the study.

The Tobit analysis was also carried out to understand the relationship of various variables with the efficiency of the commercial banks. The large size of the banks along with the high equity and profitability helps the commercial banks to utilize their resources at an optimum level. It enables them to reduce their costs to enjoy economies of scale as well as high profits. The commercial banks need to control their losses on advances, since they not only increase the cost of doing business but also decrease the profitability of the commercial banks. In addition, the regulators also need to make policy which is able to control impairment losses on loans and advances, so as to financially strengthen the banking industry in Pakistan.

The financial crisis has negatively affected the efficiency of commercial banks but the results are not significant. This result is due to the fact that the SBP has efficiently controlled the commercial banks in Pakistan which saved the banking industry from a drastic fall in efficiency. The Fitch credit agency declared that the Pakistani banking industry, irrespective of the bad macroeconomic condition and financial crisis, has gradually evolved from a weak system to a slightly healthier and active private sector driven system. Moreover, the better control of the SBP is also evident from the zero default rate of commercial banks in Pakistan. Future research can be carried out to compare the efficiency of banks in Pakistan with the other developing countries, like SAARC.

The efficiency analysis of commercial banks has various implications for regulators, managers and investors in emerging economies. Our research findings suggest that, on one hand, regulators should continue the policy of increasing the minimum capital requirements in commercial banks because equity and the financial regulations are found positively associated with efficiency scores. This will improve the solvency of commercial banks, which will not only decrease the risk of default but also enhance the level of

efficiency. On the other hand, our study demonstrates that larger commercial banks are more efficient compared to their smaller counterparts. Therefore, commercial banks should grow to achieve a high efficiency level through mergers and acquisitions. Large commercial banks with high levels of equity and investment are more efficient compared to their small counterparts, therefore investors are advised to select large commercial banks for their investment, since they optimally utilize their inputs to produce maximum outputs. It is also proposed that investors take precautions while selecting Islamic banks since they are in the developmental stage and have a low efficiency level, in particular profit efficiency when compared to conventional commercial banks.

Future research can be carried out to analyze other important aspects of commercial banks. It is suggested that researchers can compare the efficiency of commercial banks with other emerging economies in the region like India, Sri Lanka, Bangladesh, etc. Moreover, researchers can also consider other parametric and non-parametric techniques to estimate the efficiency scores. Finally, the efficiency of Islamic banks can be compared with other Islamic banks around the globe.

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